



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

h.7

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

09/890,143 07/26/2001 Masaki Yamamoto SHIG19990241 7584

21171 7590 04/25/2007
STAAS & HALSEY LLP
SUITE 700
1201 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005

EXAMINER

KAO, CHIH CHENG G

ART UNIT	PAPER NUMBER
----------	--------------

2882

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
--	-----------	---------------

3 MONTHS 04/25/2007 PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

09/890,143

Applicant(s)

YAMAMOTO, MASAKI

Examiner

Chih-Cheng Glen Kao

Art Unit

2882

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06 April 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 31-58 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 37 is/are allowed.
- 6) ☒ Claim(s) 31-36 and 38-58 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02 September 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after allowance or after an Office action under *Ex Parte Quayle*, 25 USPQ 74, 453 O.G. 213 (Comm'r Pat. 1935). Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, prosecution in this application has been reopened pursuant to 37 CFR 1.114. Applicant's submission filed on April 6, 2007, has been entered.

Claim Objections

2. Claims 39-41 and 43 are objected to because of the following informalities, which appear to be minor draft errors including grammatical and/or lack of antecedent problems.

In the following format (location of objection; suggestion for correction), the following correction(s) may obviate the objection(s): (claim 39, lines 1-2, "said wavefront"; inserting --phase-- after "wavefront") and (claim 43, lines 1-2, "said wavefront"; inserting --phase-- after "wavefront").

Claims 40 and 41 are objected to by virtue of their dependency. For purposes of examination, the claims have been treated as such. Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 31, 33, and 48 are rejected under 35 U.S.C. 102(e) as being anticipated by Sweeney et al. (US 6235434).

4. Regarding claim 31, Sweeney et al. discloses a method for forming an optical element (fig. 1, #110 and 130) that reflects radiation in a range from vacuum ultraviolet through X-ray (col. 3, lines 31-43), comprising forming on a substrate (fig. 1, #120) a multilayer film (fig. 1, #110 and 130) having a stack of alternating layers (fig. 1, #110) of high refractive index material and low refractive index material (col. 3, lines 38-40) to control a wavefront phase and an amplitude of emerging rays (abstract), and cutting away (col. 4, lines 54-63) a portion (fig. 1, #130) of the multilayer film stack (fig. 1, #110 and 130) in accordance with an amount of adjustment of the wavefront phase, to adjust a wavefront phase of the emerging rays (abstract).

5. Regarding claim 33, Sweeney et al. further discloses wherein the cutting away of the multilayer film is controlled by detecting a difference in a material that forms the multilayer film stack (col. 4, lines 57-60).

Art Unit: 2882

6. Regarding claim 48, Sweeney et al. discloses an exposure apparatus (col. 1, lines 43-65), comprising a multilayer film reflection mirror (fig. 1, #110 and 130) reflecting radiation in a range from vacuum ultraviolet through X-ray (col. 3, lines 31-43) and having a multilayer film (fig. 1, #110 and 130) formed by a plurality of repeated pairs of layers (fig. 1, #110), layers of each pair of layers having different refractive indexes from each other (col. 3, lines 38-40), and necessarily more than one layer among said plurality of repeated pairs of layers partially adjusting a wavefront phase of a light reflected by said multilayer film.

7. Claims 38-45, 47, 49, 53, 55, 56, and 58 are rejected under 35 U.S.C. 102(b) as being anticipated by Yamamoto et al. (Layer-by-layer design method for soft-x-ray multilayers).

8. Regarding claims 38 and 49, Yamamoto et al. discloses a method of manufacturing a multilayer film reflection mirror that reflects radiation in a range from vacuum ultraviolet through X-ray (abstract), comprising a multilayer film formed by a plurality of repeated pairs of layers, layers of each pair of layers having different refractive indexes from each other (fig. 9), and more than one layer among said plurality of repeated pairs of layers adjusting a wavefront phase of a light reflected by said multilayer film (figs. 1 and 2).

9. Regarding claim 39, Yamamoto et al. further discloses wherein said wavefront phase is adjusted with more than one layer among said plurality of repeated pairs (figs. 1 and 2).

Note that recitations (i.e., “being partially removed”) with respect to the method of forming a device are not germane to the issue of patentability of the device itself. Therefore, this limitation has not been given patentable weight.

10. Regarding claim 40, recitations (i.e., “wherein removal of the multilayer film is stopped at a portion of a layer having a relatively higher refractive index among said layers with different refractive indexes from each other”) with respect to the method of forming a device are not germane to the issue of patentability of the device itself. Therefore, this limitation has not been given patentable weight.

11. Regarding claim 41, Yamamoto et al. further discloses wherein said layer having a relatively higher refractive index is made of silicon (fig. 9, Ag/Si).

12. Regarding claims 42 and 53, Yamamoto et al. further discloses wherein the multilayer film is formed by repeated pairs of layers whose numbers exceeds a number at which reflectivity is substantially saturated (fig. 9).

13. Regarding claim 43, Yamamoto et al. further discloses wherein said wavefront phase is adjusted with more than one layer among the pairs of layers (figs. 1 and 2).

Note that recitations (i.e., “where the reflectivity is already saturated being partially removed”) with respect to the method of forming a device are not germane to the issue of patentability of the device itself. Therefore, this limitation has not been given patentable weight.

14. Regarding claims 44 and 55, Yamamoto et al. further discloses wherein reflectivity of said multilayer film is between about 15% and about 80% (fig. 9).

15. Regarding claims 45 and 56, Yamamoto et al. further discloses wherein said light is necessarily EUV light (title), since the wavelength ranges of EUV light and soft X-rays overlap.

16. Regarding claims 47 and 58, Yamamoto et al. further discloses wherein said multilayer film is one of a multilayer film formed by pairs of ruthenium and silicon layers, a multilayer film formed by pairs of rhodium and silicon layers (fig. 9, Rh/Si), a multilayer film formed by pairs of ruthenium and carbon layers, or a multilayer film formed by pairs of rhodium and carbon layers.

17. Claims 38-41, 45, 46, 48-52, 56, and 57 are rejected under 35 U.S.C. 102(b) as being anticipated by Voorma et al. (Angular and energy dependence of ion bombardment of Mo/Si multilayers).

18. Regarding claims 38 and 49, Voorma et al. discloses a method of manufacturing a multilayer film reflection mirror that reflects radiation in a range from vacuum ultraviolet through X-ray (abstract), comprising a multilayer film formed by a plurality of repeated pairs of layers, layers of each pair of layers having different refractive indexes from each other (pg. 1877, section IIA, paragraph 2), and more than one layer among said plurality of repeated pairs of

Art Unit: 2882

layers necessarily adjusting a wavefront phase of a light reflected by said multilayer film, since radiation is reflecting off different pairs of layers.

19. Regarding claims 39 and 50, Voorma et al. further discloses wherein said wavefront phase is necessarily adjusted with more than one layer among said plurality of repeated pairs being partially removed (abstract, lines 1-3).

20. Regarding claims 40 and 51, Voorma et al. further discloses wherein removal of the multilayer film is stopped at a portion of a layer having a relatively higher refractive index among said layers with different refractive indexes from each other (abstract, line 3).

21. Regarding claims 41 and 52, Voorma et al. further discloses wherein said layer having a relatively higher refractive index is made of silicon (abstract, line 3, "Si").

22. Regarding claims 45 and 56, Voorma et al. further discloses wherein said light is EUV light (pg. 1877, section IIA, second paragraph).

23. Regarding claims 46 and 57, Voorma et al. further discloses wherein said multilayer film is formed by pairs of molybdenum and silicon layers (title).

24. Regarding claim 48, Voorma et al. further discloses an exposure apparatus (pg. 1877, section IIA, second paragraph).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

25. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sweeney et al. as applied to claim 31 above, and further in view of Yamamoto et al.

Sweeney et al. discloses a method as recited above.

However, Sweeney et al. fails to disclose wherein a multilayer film stack is formed in a number of cycles larger than that necessary to substantially saturate a reflectance.

Yamamoto et al. teaches wherein a multilayer film stack is formed in a number of cycles larger than that necessary to substantially saturate a reflectance (fig. 9).

It would have been obvious to one having ordinary skill in the art at the time the invention was made, to modify the method of Sweeney et al. with the number of cycles of Yamamoto et al., since one would have been motivated to make such a modification for ensuring that enough reflectance is obtained (fig. 9; and pg. 1629, col. 2, second full paragraph) as implied from Yamamoto et al., which will maximize the radiation intensity.

26. Claim 34 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sweeney et al. as applied to claim 33 above, and further in view of Smith (US 4590376).

Sweeney et al. discloses a method as recited above.

Art Unit: 2882

However, Sweeney et al. fails to disclose wherein a difference in material is detected by monitoring a secondary electron discharge.

Smith teaches wherein a difference in material is detected by monitoring a secondary electron discharge (col. 1, lines 6-12).

It would have been obvious to one having ordinary skill in the art at the time the invention was made, to modify the method of Sweeney et al. to include the monitoring of Smith, since one would have been motivated to make such a modification for better monitoring quality (col. 1, line 12) as implied from Smith.

27. Claims 35 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sweeney et al. as applied to claim 33 above, and further in view of Iketaki (US 5163078).

Sweeney et al. discloses a method as recited above.

However, Sweeney et al. fails to disclose wherein a difference in material is detected by monitoring an optical change of characteristics, wherein said optical change of characteristics monitored is a change in an optical constant of visible rays or a change based on ellipsometry.

Iketaki teaches wherein a difference in material is detected by monitoring an optical change of characteristics, wherein said optical change of characteristics monitored is a change in an optical constant of visible rays or a change based on ellipsometry (col. 5, lines 25-31).

It would have been obvious to one having ordinary skill in the art at the time the invention was made, to modify the method of Sweeney et al. to include the monitoring of Iketaki, since one would have been motivated to make such a modification for better keeping film fabrication within tolerances (col. 5, lines 25-31) as shown by Iketaki.

28. Claims 42-44 and 53-55 are rejected under 35 U.S.C. 103(a) as being unpatentable over Voorma et al. as applied to claims 38 and 49 above, and further in view of Yamamoto et al.

29. Regarding claims 42 and 53, Voorma et al. discloses a device and method as recited above.

However, Voorma et al. fails to disclose wherein a multilayer film is formed by repeated pairs of layers whose numbers exceeds a number at which reflectivity is substantially saturated.

Yamamoto et al. teaches wherein a multilayer film is formed by repeated pairs of layers whose numbers exceeds a number at which reflectivity is substantially saturated (fig. 9).

It would have been obvious to one having ordinary skill in the art at the time the invention was made, to modify the device and method of Voorma et al. with the repeated layers of Yamamoto et al., since one would have been motivated to make such a modification for ensuring that enough reflectance is obtained (fig. 9; and pg. 1629, col. 2, second full paragraph) as implied from Yamamoto et al.

30. Regarding claims 43 and 54, Voorma et al. further discloses wherein said wavefront phase is necessarily adjusted with more than one layer among the pairs of layers being partially removed (abstract, lines 1-3).

Regarding claim 43, also note that recitations (i.e., "where the reflectivity is already saturated being partially removed") with respect to the method of forming a device are not

Art Unit: 2882

germane to the issue of patentability of the device itself. Therefore, this limitation has not been given patentable weight.

31. Regarding claims 44 and 55, Voorma et al. further discloses wherein reflectivity of said multilayer film is between about 15% and about 80% (fig. 6).

Also note that it would have been obvious, to one having ordinary skill in the art at the time the invention was made, to modify the device and method of Voorma et al. as modified above with the reflectivity range recited above, since where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. One would have been motivated to make such a modification for ensuring that enough reflectance is obtained.

Allowable Subject Matter

32. Claim 37 is allowed. The following is a statement of reasons for the indication of allowable subject matter.

Regarding claim 37, the prior art fails to disclose or fairly suggest a method for forming an optical element that reflects radiation in a range from vacuum ultraviolet through X-ray, including the step of cutting away a portion of a correction film and a multilayer film stack in accordance with an amount of adjustment of a wavefront phase of emerging rays, in combination with all the limitations in the claim.

Art Unit: 2882

Response to Arguments

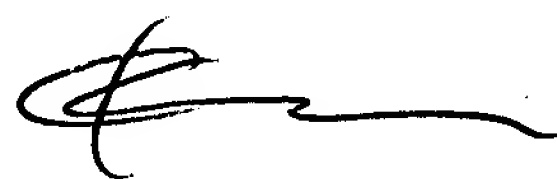
33. Applicant's arguments with respect to claims 31-36 and 38-58 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chih-Cheng Glen Kao whose telephone number is (571) 272-2492. The examiner can normally be reached on M - F (9 am to 5 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ed Glick can be reached on (571) 272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



Chih-Cheng Glen Kao
Examiner
Art Unit 2882